Measuring trade-offs in nephrology: A systematic review of discrete choice experiments and conjoint analysis studies

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Title: Measuring trade-offs in Nephrology: A Systematic Review of Discrete Choice Experiments and Conjoint Analysis studies.

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Contribution of authors:

Dr MD Clark designed the study, independently reviewed all the primary studies for eligibility and data extraction, produced a first draft of the manuscript including all tables and figures, and revised the subsequent drafts.

Professor A Szczepura independently reviewed several primary studies for eligibility and data extraction, contributed to the writing of the methods and discussion sections and revised all drafts of the manuscript.

Dr A Gumber contributed to the study design and development of the search strategy to ensure inclusion of ethnicity / language group considerations, independently reviewed several primary studies for eligibility and data extraction, and revised all drafts of the manuscript.

Professor K Howard independently reviewed several primary studies for eligibility and data extraction, and commented upon all versions of the draft manuscript and appendices.

Dr D Moro independently reviewed several primary studies for eligibility and data extraction, and commented upon all versions of the draft manuscript and appendices.

Associate Professor RL Morton contributed to the design of the review, undertook independent full text reviews of primary studies, edited and refined successive drafts of the manuscript.

All authors read and reviewed the final manuscript before submission.

Abstract:

Background: Discrete Choice Experiment [DCE], Conjoint Analysis [CA], or Adaptive Conjoint Analysis [ACA] methods are increasingly applied to obtain patient, clinician or community preferences in nephrology. This study systematically reviews the abovementioned published choice studies providing an overview of the issues addressed, methods, and findings.

Methods: Choice studies relating to nephrology were identified using electronic databases, including Medline, Embase, PsychINFO and Econlit from 1990 to 2015. For inclusion in the review, studies had to primarily relate to kidney disease and include results from statistical (econometric) analyses of respondents' choice or preference. Studies meeting the inclusion criteria were assessed against a range of systematic review criteria, and methods and results summarised.

Results: We identified 14 eligible studies from Europe, Australasia, North America, and Asia, reporting preferences for treatment or screening, patient experiences, quality of life, health outcomes and priority setting frameworks. Specific contexts included medical interventions in kidney transplantation and renal cell carcinoma, health policies for organ donation and allocation, dialysis modalities and end-of-life care; using a variety of statistical models. The characteristics of 'time' (i.e. transplant waiting time, dialysis hours, transport time) and 'quality of life' (pre and post-transplant, or pre and post-dialysis) consistently influenced patient and clinician preferences across the choice studies.

Conclusions: Discrete choice experiments are increasingly used to obtain information about key preferences in kidney transplantation and dialysis. These study methods provide quantitative information about respondents' trade-offs between conflicting clinical and policy objectives, and can establish how preferences vary among stakeholder groups.

Keywords: Conjoint Analysis, Discrete Choice Experiment, Dialysis, Transplantation, Kidney Disease, Preferences.

Summary sentences:

Discrete Choice Experiments and Conjoint Analyses are increasingly used to study preferences in nephrology about organ donation and organ allocation decisions, and dialysis modality preferences.

Such choice studies can assess preferences for treatments and policies from a variety of stakeholders including nephrologists, patients, caregivers, and the broader community.

They highlight the trade-offs people make between multiple objectives in transplantation and dialysis care.

Introduction:

Every day in nephrology, clinicians and patients face difficult decisions about treatment options, best practice care, and the 'right' use of resources. Discrete Choice Experiments (DCE), Conjoint Analysis (CA) and Adaptive Conjoint Analysis (ACA) studies systematically quantify preferences for treatment alternatives, and measure the trade-offs people make between the characteristics of each alternative. They are grounded in Lancaster's theory of demand,[1] which assumes demand for goods and services, including health services can be related to demand for individual characteristics of the goods or services. Further theoretical details[2] are provided in the technical appendix (see Appendix A.3).

Systematic reviews of the application of DCE, CA, or ACA literature in healthcare from 1990 to 2012[3, 4] reported rapid growth in the application of such techniques from an average of just over 3 per year between 1990-2000 to 48 per year 2009-2012. The aims of this study were to review the nephrology DCE, CA, and ACA literature published since 1990; to highlight the key trade-offs patients, clinicians, and other groups make in this context; and undertake a detailed systematic outline of study methodology.

Methods

Using keywords including (Nephrology OR Kidney OR Renal) AND (Discrete Choice OR Conjoint Analysis) in Medline, Embase, PsychINFO and Econlit from 1st January 1990 to 31st December 2015 we identified studies that used DCE, CA, or ACA methodology, applied to any research question relating to nephrology. Primary studies were included in the systematic review if they contained empirical (statistical or econometric) analyses; study protocols, conference abstracts, reviews and

opinions pieces were excluded. We followed criteria used in two previous reviews for study designs of this type,[3, 4] and further details are within the electronic appendices.

DCE and CA survey studies involve a comparison between 2 or 3 alternatives. The characteristics (known as attributes) of these alternatives are identical, but levels of characteristics change. Figure 1 provides an example of a DCE scenario, and Table 1 displays all of the attribute levels. With both DCE and CA formats, the range of choices faced is pre-determined before choices are made. In contrast, ACA methods use similar choices, but are 'adaptive' because scenarios are generated by an adaptive computer programme taking into account previous responses. These approaches (DCE, CA, and ACA) have an advantage over other ranking or rating techniques such as Likert scales because they facilitate a relative quantitative valuation of different characteristics as opposed to trying to value or rank the alternative as a 'whole.'

FIGURE 1: Example of a choice set (scenario) in a DCE of nephrologists' preferences for dialysis recommendation in elderly ESKD patients used in the reviewed DCE analysis cited in the reference list by Foote et al 2014.

	Patient A	Patient B	Neither
Age	90	85	
Gender	Male	Female	
Cognitive state	Normal	Somewhat impaired	
Comorbid burden	CAD, CVD, PVD	CAD, CVD, PVD	
Life expectancy	1 year	1 year	
Quality of life	Medium	Medium	
Change in quality of life	Expected to decrease	Expected to decrease	
Family/close person support	High	Medium	
Patient inclination to dialyse	Undecided	Inclined	
Family/close person inclination to dialyse	Disinclined	Undecided	
Which patient would you **prefer** to recommend dialysis to?	○	○	○

The attribute levels were allowed to vary across choice sets as set out in table 1.

Table 1: Characteristics and their levels in the 12 choice sets (scenarios)

Characteristics	Levels
Patient age	75 85 90
Patient gender	Male Female
Patient cognitive state	Normal Somewhat impaired Greatly impaired
Patient comorbid burden	Diabetes Diabetes/coronary artery disease Diabetes/CVD*/peripheral vascular disease
Patient life expectancy (with dialysis)	1 year 3 years 5 years
Patient QOL (baseline)	Low Medium High
Patient change in QOL (with dialysis)	Expected to decrease Expected to be maintained Expected to improve
Family/close person support	Low Medium High
Patient inclination to dialyse	Inclined Undecided Disinclined
Family/close person inclination for patient to dialyse	Inclined Undecided Disinclined

*CVD = cerebrovascular disease

Results

We identified 14 eligible studies from Europe, Australia, New Zealand, North America, and Asia, that reported preference information for a wide range of stakeholder groups including patients, cliniciansheathcare professionals, caregivers, donors, relatives of deceased donors, and the general community. Studies elicited preferences for medical interventions in kidney transplantation, health policies for organ donation and allocation, dialysis modalities, and end-of-life care. Methodological

criteria for each study are listed in Tables S1-S15. We provide information about the country of analysis, number of respondents, and category or categories of primary choice studies (Table 2), as reported in previous systematic reviews of DCE, CA, and ACA literature in healthcare.

Transplantation studies

One CA in the United States among 175 patients,[5] investigated the acceptability of receiving a kidney from a donor at increased risk of blood-borne viral infection (DIRVI). The analysis contained 3 attributes relating to HIV infection risk, donor age, and transplant waiting time. Findings suggested longer waiting time (P<0.01), lower donor age (P<0.01), lower donor HIV risk, participant being on dialysis (P<0.01), and older participant age (P=0.04), significantly affected preferences. Overall 42 respondents (24%) would not accept a DIRVI kidney in any scenario; 103 (59%) would accept a DIRVI kidney in some scenarios; and 31 (18%) would accept a DIRVI kidney in all scenarios. Patients were more likely to accept DIRVI kidneys when the waiting time was longer (P<0.01); the donor was younger (P<0.01); and HIV risk was lower (P<0.01). Patients on dialysis (P<0.01) and older patients (P<0.01) would be more likely to accept DIRVI kidneys.

Another DCE in the UK assessed preferences of 908 patients for 6 kidney transplant allocation criteria.[6] Findings were presented in terms of a marginal rate of substitution (MRS) that is, a trade-off relative to waiting an additional year for a kidney transplant. Results suggested that among patients who were not from an ethnic minority group, all attributes were significant. Findings suggested a pronounced preference for prioritising patients with moderate not severe diseases affecting life expectancy (MRS = 15.93), but paradoxically no preference for 'no diseases versus moderate diseases,' affecting life expectancy. Other significant attributes included a 1% improvement in kidney survival (MRS = 1.54); having an extra dependent adult or child (MRS = 1.35);

Table 2. Country of analysis and standardised category (or categories)* of primary choice studies.

Authors.	Country of analysis	Number of respondents	A. Patient Consumer Experience	B. Valuing Health Outcomes.	C. Investigating trade-offs health outcomes and patient or consumer experience factors.	D. Estimating utility weights within the QALY framework	E. Job Choices for preferences relating to medical posts or healthcare human resource policy.	F. Developing priority setting frameworks.	G. Health Professionals preferences for treatment or screening options for patients	H. Other
Clark et al (2009)	UK	908 patients	-	-	✓	-	-	✓	-	-
Clark et al (2012)	UK	908 patients,41 Carers, 113 Healthcare professionals	-	-	✓	-	-	✓	✓	-
Davison et al (2010)	Canada	169 patients, 29 Carers	✓	-	-	-	-	✓	✓	-
Foote et al (2014)	Australia and New Zealand	159 Nephrologists	-	-	-	-	-	-	✓	-
Halpern et al (2004)	USA	126 patients	-	-	✓	-	-	-	-	-
Howard et al (2015a)	Australia	2051 Community respondents	-	-	✓	-	-	✓	-	-
Howard et al (2015b)	Australia	2005 Community respondents	-	-	-	-	-	-	-	✓
Kjaer et al (2012)	Greenland	206 Public preferences	-	-	-	-	-	✓	-	-
Mohamed et al (2011)	USA (+respondents from Australia, Canada, UK)	138 patients	-	-	✓	-	-	-	-	-
Morton et al (2012a)	Australia	105 Patients, 73 Carers	-	-	✓	-	-	-	-	-

Morton et al (2012b)	Australia	105 Patients	-	-	✓	-	-	-	-	-
Park et al (2012)	South Korea	120 Patients, 52 Family members, 272 Healthcare professional	-	-	✓	-	-	-	✓	-
Reese et al (2010)	USA	175 patients	-	-	✓	-	-	✓	-	-
Whitman et al (2013)	USA	305 Nephrologists	-	-	-	-	-	-	✓	-
Total			1	0	9	0	0	6	5	1

A blank cell suggests that the paper does not fulfil this criterion, whereas the symbol ✓ implies that the criterion is met.

* Standard categories used in prior systematic reviews of DCE studies in the healthcare literature.

a one-year reduction in recipient age (MRS = 0.16); having no disease other than kidney disease affecting quality of life (MRS = -2.48); and having moderate rather than severe diseases affecting quality of life (MRS = 4.08), as was transplant waiting time (MRS = 1). Those who were not from ethnic minorities would prioritise transplants to patients with a better tissue match to the donor, whereas non-white ethnic minorities would not.

In a later analysis[7] the same DCE was applied to 908 patients, 41 carers, 113 healthcare professionals, and 48 live donors /relatives of deceased donors. Similarly, findings suggested a pronounced preference for prioritising patients with moderate, not severe, diseases affecting life expectancy (MRS = 15.32). A 1% improvement in kidney survival (MRS = 1.41); having an extra dependent adult or child (MRS = 1.43); a one year reduction in recipient age (MRS = 0.16); having no diseases other than kidney disease affecting quality of life (MRS = -2.73); and having moderate rather than severe diseases affecting quality of life (MRS = 4.18) were also valued relative to a 1 year transplant wait. Healthcare professionals' valued prioritising patients with better tissue matches lower than patients but prioritised younger recipients and those with dependents higher. They prioritised those with none versus moderate diseases, affecting life expectancy whereas patients did not, and they prioritised those with moderate rather than severe diseases higher than patients. Assessment of preferences for live donors or relatives of deceased donors, and carers, was limited by small sample sizes.

A DCE assessed community preferences for the allocation of donor organs for transplantation (including kidneys and other organs) in Australia[8] using a sample of 2,051 community respondents. This study had 15 attributes. Findings suggested most of the variables for transplant allocation criteria were significant at the 0.001 level, with the exception of having previous cancer, which was significant at the 1% level (p=0.01); recipient sex, and having diabetes which were non-significant

(p>0.05). Mixed logit analysis suggested that allocation to people aged 5 (β= 0.662), 15 (β= 0.562), or 25 (β= 0.380), was preferred compared to recipients aged 40 (β= -0.163), whilst allocation to those aged 55 (β= -0.277), or 70 (β= -1.164), was less preferred to those aged 40. Those with previous transplant(s) (β= -0.146), and those who did not follow their doctor's advice (β= -0.059), were given a lower priority. Those with caring responsibilities (β= 0.351), or whose family were registered as donors (β= 0.186), were prioritised more; those with long waiting times were prioritized (β= 0.042); those with lower life expectancy without a transplant (β= -0.87), and higher life expectancy post-transplant (β= 0.058), were prioritised; those with lower quality of life without a transplant (β= 0.057), and higher quality of life post-transplant (β= 0.112), were prioritised. Those with comorbidities such as diabetes and previous cancer (β=- 0.088), and hepatitis and other viral diseases which were being treated (β= -0.217), were prioritised less. Compared to non-smokers, ex-smokers (β= -0.265), or current smokers (β= -0.751), were given lower priority, as were those consuming alcohol occasionally (β= -0.093) or more than 5 nights a week (β= -0.350). Obese people (β= -0.266), compared to non-obese people were also given lower priority.

A second DCE analysis[9] investigated the preferences of 2,005 Australian community respondents for organ donation policy. The impact of 8 policy attributes was assessed. The analysis suggested that the type of donation consent system and availability of family priority for transplants in the future did not influence community preferences. Results were presented in terms of odds ratios (OR), whereby an OR >1 for an attribute suggested that as the level of the attribute increased, policy alternative A was preferred over policy B. Respondents favoured a policy where the donor's family still had some, but not all, involvement in the final donation decision; however a policy where family always has the final say (OR), 0.25; 95% confidence interval [95%CI], 0.21-0.28), or never has the final say (OR, 0.50; 95%CI, 0.44-0.56) was significantly less preferred. Respondents also preferred a policy where the registration process was easy (OR, 1.16; 95%CI, 1.09-1.24), e.g. sending all adults a

registration form and reply paid envelope; where reconfirmation of donation intent was less frequent (for example, annual confirmation: OR, 0.88; 95%CI, 0.78-0.98); where there was a direct payment (OR range 1.19-1.32) or reimbursement of funeral expenses (OR range 1.18-1.55); and where there was some formal recognition of donation, for example, a letter to the donor's family (OR, 1.14; 95%CI, 1.04-1.27), or the donor's name placed on a memorial (OR, 1.29; 95%CI, 1.14-1.45).

Dialysis studies

A CA in the US examined the willingness of 126 patients to switch dialysis modality from conventional to more frequent dialysis.[10] The authors established the impact of 4 attributes including life expectancy, quality of life, the annual number of hospitalisations, and transport time. All 4 attributes were significantly associated with a willingness to switch to daily haemodialysis in the hypothesised direction. Findings showed that 44% of respondents receiving conventional haemodialysis 3 times per week would not switch to daily 6 times per week haemodialysis regardless of the health benefits. Of the 56% who said they might switch to this regimen, the majority would only switch for substantive health benefits.

A second dialysis DCE investigated public preferences among 206 respondents for the location of dialysis facilities for residents of Greenland.[11] This involved 3 attributes including recruitment of nephrologists, location of patient accommodation, and increase in taxation required for dialysis. All the variables relating to these 3 attributes were significant at the 1% level, and standard deviations were significant for all random parameter logit variables (indicating statistically significant preference heterogeneity - see appendix A.2 for details). A key finding was that hypothetical alternatives involving treatment in Greenland (versus treatment in Denmark) were chosen in nearly two-thirds of cases, implying a ‘slight tendency’ to favour treatment in Greenland despite increased

taxation. Respondents were willing to pay 30 Euro more in increased taxes per person per year to see a permanent nephrologist than a non-permanent (visiting) nephrologist. The provision of accommodation required to undertake dialysis in apartments was valued at 70 Euro, and in hotels at 88 Euro of increased taxation per person per year. The statistically significant model constant, implied an overall preference in favour of dialysis in Greenland (valued at 63 Euros).

A DCE in Australia assessed preferences for dialysis modality among 105 pre-dialysis patients and 73 caregivers.[12] Informed by preliminary research,[13, 14] 3 treatment alternatives for home dialysis, in-centre dialysis and non-dialytic conservative care were created. The alternatives were described by 7 attributes including average survival time, number of visits per week to hospital for dialysis, ability to travel or 'go away' on short trips, hours of dialysis per treatment, time of day the dialysis can be undertaken, provision of a transport service to attend dialysis or doctors' appointments, and whether there was flexibility to change dialysis and times. Findings reported home-based dialysis was chosen 65% of the time and in-centre dialysis 35% of the time. Comparing dialysis versus conservative care, 90% of respondents chose a dialysis option and 10% chose a non-dialysis (conservative care) option. In the main analysis for patients, 2 variables for home-based dialysis (life expectancy [OR, 1.68], travel restrictions [OR, 0.37]) were significant with another 8 variables non-significant. Similarly, 1 attribute for in-centre haemodialysis (longer hours [OR, 2.02] was significant. Among caregivers, home dialysis was chosen 72% of the time, in-centre dialysis 25% of the time, and conservative care in 3%. Moreover, 3 out of 9 variables relating to home dialysis compared to conservative care (life expectancy [OR, 1.82], dialysis at night [OR, 0.03], and travel restrictions with home dialysis [OR, 0.43]) were significant. Similarly, amongst caregivers when comparing in-centre haemodialysis with conservative care 2 out of 11 variables (dialysis at night time [OR, 0.03] and hours with in centre dialysis [OR, 2.67]) were significant. All significant variables were in the expected direction.

A second analysis from the same research teams[15] elicited preferences among 105 respondents for dialysis versus conservative non-dialytic care in Australia. Findings suggested patients preferred dialysis to conservative care if dialysis increased average life expectancy (OR, 1.84; 95%CI, 1.57-2.15), if they could dialyse during the day or evening rather than during the day only (OR, 8.95; 95%CI, 4.46-17.97), and if subsidised transport was available (OR, 1.55; 95%CI, 1.24-1.95). Patients were less likely to choose dialysis over conservative care if more hospital visits were required (OR, 0.70; 95%CI, 0.56-0.88), and with more restrictions on travel (OR, 0.47; 95%CI, 0.36-0.61). Patients would forgo 7 months life expectancy to reduce the number of visits to the hospital, and 15 months to increase their ability to travel.

Another DCE[16] looked at the preferences of 159 Australian nephrologists for dialysis in elderly patients with end-stage kidney disease. The DCE included 10 attributes. Findings indicated all patient characteristics (except sex) significantly affected the likelihood of nephrologists recommending dialysis. Nephrologists were more likely to recommend dialysis for patients with preserved cognition (OR, 68.3; 95%CI, 33.4-140.0), lower comorbidity (OR, 2.1; 95%CI, 1.1-4.1), increased life expectancy (OR, 2.8; 95%CI, 2.1-3.7), high current QOL (OR, 2.8; 95%CI, 2.0-3.8), and positive patient and family dialysis inclination (OR, 27.5; 95%CI, 16.2-46.8 and OR, 2.0; 95%CI, 1.3-3.3, respectively). Nephrologists over 65 years were more likely to recommend dialysis than younger nephrologists. Overall, nephrologists would forgo 12 months of patient survival to avoid substantial quality of life decreases associated with dialysis.

An ACA[17] investigated preferences among 305 US nephrologists for blood transfusion in chronic dialysis patients. The analysis incorporated 10 attributes. Findings presented in terms of relative

importance of attributes suggested that haemoglobin level (g/dl) accounted for 29% of decision-making, followed by functional status (16%), cardiovascular disease (12%), clinical scenario (9%), ESA status (9%), age (7%), haemoglobin stability over time (6%), kidney transplant eligibility (5%), iron indices (4%), and evidence of occult blood in stool: Fecal Occult Blood Test or Fecal Immunochemical Test positive (3%).

Combined dialysis, end-of-life & transplantation

One Canadian DCE,[18] assessed the preferences of 169 patients, 29 caregivers, and 150 healthcare professionals. Dialysis-related attributes included 'Who provides comprehensive day to day care for patients on dialysis?' and 'How decisions to stop dialysis should be made'. Transplantation attributes included 'How deceased donor kidneys should be allocated for transplantation', and 'How should live kidneys for transplantation be obtained?' Other attributes related to 'end-of-life' issues including 'When should end-of-life care discussions commence?' and 'How much information on prognosis and end-of-life care issues should be routinely provided?' All the attributes were significant, with the exception of some levels for the attribute about who provides comprehensive day-to-day care on dialysis. Regression coefficients suggested that for all respondents early 'end-of-life care' discussions (0.72) were preferred to late (0.00); detailed information on prognosis and end-of-life care was preferred to limited information (0.56 vs 0.00); whereas medical and personal decisions (0.34) as opposed to personal decisions only (0.00) was preferred for decisions about stopping dialysis.

In relation to how deceased donor kidneys should be allocated, the 'best match' approach (0.81) was preferred to 'first come first served' (0.00). With respect to how live kidneys for transplantation should be obtained, receiving an organ from an unknown donor (-0.43), via a paired kidney exchange (-0.80), or buying a kidney (-1.93) were less preferable than receiving a kidney from a family member

or close friend (0.00). For the attribute of providing day-to-day dialysis care, the family physician (-0.51) was less preferable than 'family physician and group of kidney specialists' (0.25), whilst the 'advanced nurse practitioner and group of kidney specialists' was non-significant.

Renal cancer studies

A DCE assessed 120 patients, 52 family members, and 272 healthcare professionals' preferences for targeted renal cell carcinoma therapy in South Korea.[19] The analysis involved 6 attributes. All the attributes were significant at the 1% level for patients and health professionals. Additional months of progression-free survival were positively valued at 7-31% in terms of relative importance; additional months of bone marrow suppression was negatively valued at 18-36%; the increased likelihood of hand-foot skin reaction was negatively valued at 12-23% ; increased likelihood of gastrointestinal perforation was valued at between 4-13%: increased risk of bleeding was valued at between 11-14%; and administration by injection versus orally was valued at 13-22% in terms of relative importance of attributes according to the stakeholder group.

A second DCE assessed benefit-risk preferences for targeted agents in the treatment of renal cell carcinoma in 138 US patients.[20] The respondents faced questions relating to hypothetical renal cell carcinoma profiles. The profiles were defined by attributes including efficacy (progression-free survival [PFS]), when overall survival was constant), tolerability effects (fatigue / tiredness, diarrhoea, hand-foot syndrome, mouth sores) and serious adverse events (liver failure, blood clot). Findings suggested PFS was the most important attribute for patients. The remaining attributes were ranked in decreasing order of importance: fatigue / tiredness, diarrhoea, liver failure, hand-foot syndrome, blood clot, and mouth sores. A key finding was that to increase PFS by 11 months, patients would accept a maximum blood clot risk of 3.1% (95%CI 1.5-5.3) or liver failure risk of 2.0% (95%CI 1.0-3.3).

Discussion

DCE and CA studies provide several advantages over traditional surveys. First, they provide a quantitative estimate of the *relative* importance of one attribute of a treatment or program compared to another, rather than a rating (e.g. Likert scale), or a ranking (simple ordering of characteristics from most important to least important). The estimate of relative importance enables the researcher to calculate trade-offs, i.e. what amount of one attribute a person is prepared to give up in order to gain more of another attribute. This trade-off cannot be calculated from traditional surveys. Second, DCE and CA studies allow the estimation of preferences for options that do not yet exist. For example, a policy to reimburse a kidney donor for their personal time given to be screened for donation, attend the required medical visits, and recover from their donor nephrectomy operation. This is possible because DCEs and CAs use hypothetical scenarios containing plausible and realistic attributes. Third, DCEs and CAs enable market forecasting of new treatments that can help in health service planning. For example, planning integrated renal-palliative care medical services based on the proportion of people with end-stage kidney disease who might choose conservative kidney management if the alternative were offered to them.

The difficulties of DCEs and CAs compared to other surveys may include the minimum level of cognitive ability that is required to comprehend the choice question posed. The cognitive burden is considered greater than a simple rating or ranking task. In nephrology, this can be an issue if one seeks to elicit preferences from people with advanced chronic kidney disease. A second difficulty compared to traditional surveys is the level of statistical or econometric expertise needed in the design and analysis of the DCE or CA surveys. At a minimum the analyst needs to have good quantitative data skills, familiarity with regression analysis and writing code in statistical software such as Nlogit. However the challenges are not insurmountable, as many universities run specific

training courses in DCE design and analysis, and economists/ health economists have applied these techniques in different areas now for close to two decades.

The published literature in nephrology provides important insights about the preferences of key stakeholder groups for treatment of kidney disease, highlighting several major implications for policy. In kidney transplantation the current allocation criterion of 'first come first served' is broadly consistent with preference studies, in particular the value placed on 'equity' criteria for prioritising those who have waited a long time; however other factors not currently considered may be equally important. These include the donor status of the patient or family; the number of previous transplants; and whether the recipient has child or adult dependents. This would indicate that the current allocation policy in many countries may need to change. In dialysis, two separate DCE studies identified a preference among patients for longer rather than shorter treatment time (i.e. hours or number of days per week) when resulting health benefits could be delivered. This indicates that the current minimum standards in international dialysis guidelines for fluid and solute clearance may not be aligned with patient preferences, and provision of other modalities such as home dialysis that enable increased hours, should be offered.

Looking to the future, several choice studies in nephrology are planned, including patient preferences for kidney transplant monitoring by video-conferencing,[21] preferences for outcomes after kidney transplantation,[22] and patient and family preferences for home versus facility-based dialysis in New Zealand.[23]

Conclusions

This review has evaluated the content and methodology of choice studies in nephrology. These study designs are increasingly used to obtain information about key preferences in kidney transplantation and dialysis. In contrast to other methods they provide quantitative information

about respondents' trade-offs between conflicting objectives, and can establish how policy-relevant preferences vary among stakeholder groups.

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Supplementary Table 1. Type of DCE and number of attributes.

Authors	Non-labelled choice	Labelled choice	Number of attributes to be seen by respondents	Number of attributes is 2-3	Number of attributes is 4-5	Number of attributes is 6	Number of attributes is 7-9	Number of attributes is 10	Number of attributes is >10
Clark et al (2009)	✓	-	6	-	-	✓	-	-	-
Clark et al (2012)	✓	-	6	-	-	✓	-	-	-
Davison et al (2010)	✓	-	6	-	-	✓	-	-	-
Foote et al (2014)	✓	-	10	-	-	-	-	✓	-
Halpern et al (2004)	-	✓	4	-	✓	-	-	-	-
Howard et al (2015a)	✓	-	15	-	-	-	-	-	✓
Howard et al (2015b)	✓	-	8	-	-	-	✓	-	-
Kjaer et al (2012)	-	✓	3	✓	-	-	-	-	-
Mohamed et al (2011)	✓	-	7	-	-	-	✓	-	-
Morton et al (2012a)	✓	-	7	-	-	-	✓	-	-
Morton et al (2012b)	✓	-	7	-	-	-	✓	-	-
Park et al (2012)	✓	-	6	-	-	✓	-	-	-
Reese et al (2012)	-	✓	3	✓	-	-	-	-	-
Whitman et al (2013)	✓	-	10	-	-	-	-	✓	-
Total	**11**	**3**	**-**	**2**	**1**	**4**	**4**	**2**	**1**

Supplementary Table 2. Details of domains covered by attributes, number of respondent groups, and details of administration of the survey.

Authors.	Attributes covered – Monetary measure	Attributes covered – Time	Attributes covered – Risk	Attributes covered – Health status domain	Attributes covered – Health care	Attributes covered - Other	Number of main key respondent groups	Administra-tion of survey – Self completed question-naires.	Administra-tion of survey – Interview-er administ-ered	Administration of survey – Computerized review or via computer	Administration of survey – Not clearly reported
Clark et al (2009)	-	✓	✓	✓	✓	✓	1[1]	✓	✓	-	-
Clark et al (2012)	-	✓	✓	✓	✓	✓	4	✓	✓	-	-
Davison et al (2010)	-	✓	-	✓	✓	✓	3	✓	-	-	-
Foote et al (2014)	-	✓	✓	✓	✓	✓	1	-	-	✓	-
Halpern et al (2004)	-	✓	-	✓	✓	✓	1	-	✓	-	-
Howard et al (2015a)	-	✓	✓	✓	✓	✓	1	-	-	✓	-
Howard et al (2015b)	✓	-	-	-	✓	✓	1	-	-	✓	-
Kjaer et al (2012)	✓	✓	-	-	✓	-	1	✓	✓	-	-
Mohamed et al (2011)	-	✓	✓	✓	✓	-	1	-	-	✓	-
Morton et al (2012a)	✓	✓	-	✓	✓	✓	2	✓	-	-	-
Morton et al (2012b)	✓	✓	-	✓	✓	✓	1	✓	-	-	-
Park et al (2012)	-	✓	✓	✓	✓	✓	2	✓	✓	✓	-
Reese et al (2010)	-	✓	✓	✓	✓	✓	1	-	-	-	✓
Whitman et al (2013).	-	✓	✓	✓	✓	✓	2	-	-	✓	-
Total	**4**	**13**	**8**	**12**	**14**	**12**	**-**	**7**	**5**	**6**	**1**

[1] This paper had one main response group (patients) however sub-group analysis relating to ethnicity and gender was conducted within this sub-group.

Supplementary Table 3. Selected details relating to survey instrument design characteristics.

Authors.	Number of alternatives presented	No information about number of alternatives presented.	Conjoint Analysis or DCE?	Adaptive Conjoint Analysis?	Best Worst Scaling Design?	Number of choice sets (scenarios) presented	Number of choices ≤ 8	Number of choices between 9 and 16	Number of choices > 16	Number of choices not clearly reported
Clark et al (2009)	2	-	✓	-	-	9	-	✓	-	-
Clark et al (2012)	2	-	✓	-	-	9	-	✓	-	-
Davison et al (2010)	2	-	✓	-	-	12	-	✓	-	-
Foote et al (2014)	3	-	✓	-	-	12	-	✓	-	-
Halpern et al (2004)	2	-	✓	-	-	21	-	-	✓	-
Howard et al (2015a)	2	-	✓	-	-	30	-	-	✓	-
Howard et al (2015b)	2	-	✓	-	-	30	-	-	✓	-
Kjaer et al (2012)	3	-	✓	-	-	9	-	✓	-	-
Mohamed et al (2011)	2	-	✓	-	-	12	-	✓	-	-
Morton et al (2012a)	3	-	✓	-	-	12	-	✓	-	-
Morton et al (2012b)	3	-	✓	-	-	12	-	✓	-	-
Park et al (2012)	2	-	✓	-	-	10	-	✓	-	-
Reese et al (2010)	2	-	✓	-	-	12	-	✓	-	-
Whitman et al (2013).	2	-	-	✓	-	Not indicated	-	-	-	✓
Total	**-**	**0**	**13**	**1**	**0**	**-**	**0**	**10**	**3**	**1**

Supplementary Table 4. Survey instrument design characteristics.

Authors.		Design type – Full Factorial	Design type – Fractional Factorial / D – efficient designs.	Design type not clearly reported	Design plan – Main effects only	Design plan – Main effects and two way interactions	Design plan – Not applicable	Design plan – Not clearly reported	Design source – Software package	Design source – Other	Design source – No further details
Clark et al (2009)		--	✓	-	✓	-	-	-	-	✓	-
Clark et al (2012)		-	✓	-	✓	-	-	-	-	✓	-
Davison et al (2010)		-	✓	-	-	✓	-	-	-	✓	-
Foote et al (2014)		-	✓	-	-	✓	-	-	✓	-	-
Halpern et al (2004)		-	✓	-	✓	-	-	-	✓	-	-
Howard et al (2015a)		-	✓	-	✓	-	-	-	✓	-	-
Howard et al (2015b)		-	✓	-	✓	-	-	-	✓	-	-
Kjaer et al (2012)		✓	✓	-	-	-	✓	-	-	-	-
Mohamed et al (2011)		-	✓	-	✓	-	-	-	✓	-	-
Morton et al (2012a)		-	✓	-	-	✓	-	-	✓	-	-
Morton et al (2012b)		-	✓	-	-	✓	-	-	✓	-	-
Park et al (2012)		-	✓	-	✓	-	-	-	-	✓	-
Reese et al (2010)		-	-	✓	-	-	-	✓	-	-	✓
Whitman et al (2013).		-	✓	-	✓	-	-	-	✓	-	-
Total		**1**	**12**	**1**	**8**	**4**	**1**	**1**	**8**	**4**	**1**

Supplementary Table 5. Details of design source.

Authors	Design source: SPEED	Design source: SPSS	Design source: SAS	Design source: Ngene	Design source: Sawtooth	Design source: Other	Design source: No further details	Design source 'Other' please describe
Clark et al (2009)	-	-	-	-	-	✓	--	Street and Burgess design.
Clark et al (2012)	-	-	-	-	-	✓	-	Street and Burgess design.
Davison et al (2010)	-	-	-	-	-	✓	-	Street and Burgess design.
Foote et al (2014)	-	-	-	✓	-	-	-	-
Halpern et al (2004)	-	-	-	-	-	-	✓	-
Howard et al (2015a)	-	-	-	✓	-	-	-	-
Howard et al (2015b)	-	-	-	✓	--	-	-	-
Kjaer et al (2012)	-	-	-	-	-	✓	-	Design template was the full factorial.
Mohamed et al (2011)	-	-	-	-	-	✓	-	Gauss version 7 – D-efficient design.
Morton et al (2012a)	-	-	-	✓	-	-	-	-
Morton et al (2012b)	-	-	-	✓	-	-	-	-
Park et al (2012)	-	-	-	-	-	✓	-	Sloans library of orthogonal arrays.
Reese et al (2010)	-	-	-	-	-	-	✓	-
Whitman et al (2013)	-	-	-	-	-	✓	-	ACBC Adaptive Conjoint Analysis design.
Total	**0**	**0**	**0**	**5**	**0**	**7**	**2**	**-**

Supplementary Table 6. Further details of design source, methods to create choice sets.

Authors	Design source: Catalogue	Design source: Website	Design source: Expert	Design source: Not clearly reported	Methods to create choice sets – Orthogonal arrays single profiles	Methods to create choice sets – Orthogonal arrays random pairing	Methods to create choice sets – Orthogonal arrays pairing with a constant comparator	Methods to create choice sets – Orthogonal arrays foldover with random pairing	Methods to create choice sets – Orthogonal arrays foldover
Clark et al (2009)	-	-	✓	-	-	-	-	-	✓
Clark et al (2012)	-	-	✓	-	-	-	-	-	✓
Davison et al (2010)	-	-	✓	-	-	-	-	-	-
Foote et al (2014)	-	-	-	-	-	-	-	-	-
Halpern et al (2004)	-	-	-	✓	-	-	-	-	-
Howard et al (2015a)	-	-	-	-	-	-	-	-	-
Howard et al (2015b)	-	-	-	-	-	-	-	-	-
Kjaer et al (2012)	--	-	-	-	-	-	-	-	-
Mohamed et al (2011)	-	-	-	-	-	-	-	-	-
Morton et al (2012a)	-	-	-	-	-	-	-	-	-
Morton et al (2012b)	-	-	-	-	-	-	-	-	-
Park et al (2012)	-	✓	-	-	-	-	-	-	✓
Reese et al (2010)	-	-	-	✓	-	-	-	-	-
Whitman et al (2013)	-	-	-	-	-	-	-	-	-
Total	**0**	**1**	**3**	**2**	**0**	**0**	**0**	**0**	**3**

Supplementary Table 7. Methods used to create choice sets.

Authors	Methods used to create choice sets: Orthogonal arrays D-efficiency (SAS).	Methods used to create choice sets: Orthogonal arrays D-efficiency (NGENE).	Methods used to create choice sets: Orthogonal arrays D-efficiency (Other).	Methods used to create choice sets: Orthogonal arrays – Other pragmatically chosen.	Methods used to create choice sets: Orthogonal arrays – Not clearly reported.	Methods used to create choice sets: Other with details if applicable.
Clark et al (2009)	-	-	-	-	-	-
Clark et al (2012)	-	-	-	-	-	-
Davison et al (2010)	-	-	-	-	✓	-
Foote et al (2014)	-	✓	-	-	-	-
Halpern et al (2004)	-	-	-	✓	-	-
Howard et al (2015a)	-	✓	-	-	-	-
Howard et al (2015b)	-	✓	-	-	-	-
Kjaer et al (2012)	-	-	-	-	-	✓Full factorial
Mohamed et al (2011)	-	-	✓ Gauss	-	-	-
Morton et al (2012a)	-	✓	-	-	-	-
Morton et al (2012b)	-	✓	-	-	-	-
Park et al (2012)	-	-	-	-	-	-
Reese et al (2010)	-	-	-	-	✓	-
Whitman et al (2013)	-	-	-	-	-	✓ Known as ACBC adaptive conjoint analysis
Total	**0**	**5**	**1**	**1**	**2**	**2**

Supplementary Table 8. Details of the DCE estimation procedure.

Authors	Estimation procedure – Probit.	Estimation procedure – Random Effects Probit.	Estimation procedure – Logit.	Estimation procedure - Random Effects Logit.	Estimation procedure – MNL / Conditional Logit	Estimation procedure – Nested Logit	Estimation procedure - Random Parameter Logit or Mixed Logit (MXL)
Clark et al (2009)	-	✓	-	-	-	-	-
Clark et al (2012)	-	✓	-	-	-	-	-
Davison et al (2010)	-	-	-	-	✓	-	-
Foote et al (2014)	-	-	-	-	-	-	✓
Halpern et al (2004)	-	-	✓	-	-	-	-
Howard et al (2015a)	-	-	-	-	-	-	✓
Howard et al (2015b)	-	-	-	-	-	-	✓
Kjaer et al (2012)	-	-	-	-	-	-	✓
Mohamed et al (2011)	-	-	-	-	-	-	✓
Morton et al (2012a)	-	-	-	-	-	-	✓
Morton et al (2012b)	-	-	-	-	-	-	✓
Park et al (2012)	-	-	-	-	✓	-	-
Reese et al (2010)	--	-	✓	-	-	-	-
Whitman et al (2013)	-	-	-	-	-	-	-
Total	**0**	**2**	**2**	**0**	**2**	**0**	**7**

Supplementary Table 9. Details of estimation procedure (continued).

Authors	Estimation procedure – Generalized Mixed Logit	Estimation procedure – Generalized Multinomial Logit.	Estimation procedure – Latent Class.	Estimation procedure – Other.	Mixed Logit / Random Parameter Logit / Latent Class Generalized Multinomial Logit / Generalized Mixed Logit - Evidence of preference heterogeneity.	Is number of replications specified when applicable?	Mixed Logit / Random Parameter Logit / Generalized Multinomial Logit / Generalized Mixed Logit – Normal.	Mixed Logit / Random Parameter Logit / Generalized Multinomial Logit / Generalized Mixed Logit– Logs.	Mixed Logit / Random Parameter Logit / Generalized Multinomial Logit / Generalized Mixed Logit– Other distribution.
Clark et al (2009)	-	-	-	-	-	-	-	-	-
Clark et al (2012)	-	-	-	-	-	-	-	-	-
Davison et al (2010)	-	-	-	-	-	-	-	-	-
Foote et al (2014)	-	-	-	-	✓	✓	✓	-	-
Halpern et al (2004)	-	-	-	-	-	-	-	-	-
Howard et al (2015a)	-	-	-	-	✓	✓	✓	-	-
Howard et al (2015b)	-	-	✓	-	✓	✓	✓	-	-
Kjaer et al (2012)	-	-	-	-	✓	✓	✓	✓	-
Mohamed et al (2011)	-	-	-	-	✓	-	✓	-	-
Morton et al (2012a)	-	-	-	-	✓	-	-	-	-
Morton et al (2012b)	-	-	-	-	✓	-	-	-	-
Park et al (2012)	-	-	-	-	-	-	-	-	-
Reese et al (2010)	-	-	-	-	-	-	-	-	-

Whitman et al (2013)	-	-	-	✓ (ACBC part-worth utility)	-	-	-	-	-
Total	**0**	**0**	**1**	**1**	**7**	**4**	**5**	**1**	**0**

Supplementary Table 10. Reporting of preference heterogeneity.

Authors	Methods for preference heterogeneity used	Details of methods for preference heterogeneity
Clark et al (2009)	✓	Interaction dummy variables to establish whether patient preferences varied by gender (Male vs. Female) and ethnicity (non-white ethnic minority patients vs. other patients; South Asian vs. other patients). Wald tests for differences in MRS.
Clark et al (2012)	✓	Interaction dummy variables to establish whether stakeholder group preferences for healthcare professionals, carers, live donors / relatives of deceased donors, varied from the patient group. Also interaction dummies to establish whether patient preferences varied between ethnic minority patients and non-ethnic minority patients. Wald tests for differences in MRS.
Davison et al (2010)	✓	Results presented separately for whole sample, healthcare providers, and patients and caregivers.
Foote et al (2014)	✓	A Mixed Logit / Random Parameters Logit was applied which allows some investigation of preference heterogeneity.
Halpern et al (2004)	✓	They included in the multivariable model each patient-level variable that had univariable associations with the willingness to switch to daily hemodialysis at the level of P<0.25. Patients who might consider switching were younger (mean age 50.9 vs. 60.1, P=0.0003) than those who would not.
Howard et al (2015a)	✓	A Mixed Logit model was applied which allowed for some investigation of preference heterogeneity.
Howard et al (2015b)	✓	In addition to a Mixed Logit Model a Latent Class Model was applied. To explore associations with class membership respondent's sociodemographic characteristics were entered into the model one at a time. Any characteristics that was significant at P < 0.1 level and resulted in equal or improved model fit (Akaike Information Criteria) was retained.
Kjaer et al (2012)	✓	Used Random Parameter Logit, and also conducted a separate econometric model for respondents not choosing the status quo.
Mohamed et al (2011)	✓	A Mixed Logit / Random Parameters Logit was applied which allows some investigation of preference heterogeneity.
Morton et al (2012a)	✓	A Mixed Logit model was applied and sociodemographic characteristics were incorporated into each model as separate variables / interaction terms.
Morton et al (2012b)	✓	A Mixed Logit model was applied and sociodemographic characteristics were incorporated into each model as separate variables / interaction terms.
Park et al (2012)	✓	Separate conditional logit models for the different sub-groups, including the patient group, and healthcare professional group. Also assessment of whether patient and healthcare professional results varied in a statistically significant manner.
Reese et al (2010)	✓	Likelihood of accepting a 'Donor at Increased Risk for blood borne Viral Infection' (DIRVI) according to the patient samples characteristics was established.
Whitman et al (2013)	✓	Results of the adaptive conjoint analysis were presented. Influence of being a non-Nephrologists vs. Nephrologist about whether you believed patient transplant eligibility should influence transfusion decisions in chronic kidney disease (CKD). Also the influence of other provider characteristics [higher monthly expenditure on dialysis, and years of practice experience] upon whether transplant eligibility should influence transfusion decisions.
-	**14**	-

Supplementary Table 11. Validity tests.

Authors.	Validity tests – External.[2]	Validity tests – Internal - Theoretical.[3]	Validity tests – Internal – Non-satiation.[4]	Validity tests – Internal – Transitivity.[5]	Validity tests – Internal – Sens expansion and contraction criteria.[6]	Validity tests – Internal – Compensatory decision making.[7]	Validity tests – Use of qualitative methods to enhance DCE process and results: Attribute selection.	Validity tests – Use of qualitative methods to enhance DCE process and results: Level selection.	Validity tests – Use of qualitative methods to enhance DCE process and results: Pre-testing questionnaire.
Clark et al (2009)	-	✓	-	-	-	-	✓	✓	✓
Clark et al (2012)	-	✓	-	-	-	--	✓	✓	✓
Davison et al (2010)	-	✓	-	-	-	-	-	-	-
Foote et al (2014)	-	✓	-	-	-	-	✓	✓	✓
Halpern et al (2004)	-	✓	-	-	-	-	-	-	✓
Howard et al (2015a)	-	✓	-	-	-	-	✓	✓	✓
Howard et al (2015b)	-	✓	-	-	-	-	✓	✓	✓

[2] External validity requires a comparison of stated preference results from DCE, CA, or ACA with revealed preferences.

[3] Theoretical validity requires that some assessment is made of whether the signs attached to significant attributes make intuitive sense, or are in line with prior expectations.

[4] Non-satiation requires that if, for any amount of a good or service, more is preferred to less, then more will be preferred to less also at all larger amounts of that good or service.

[5] Transitivity suggests that if a<b and b<c then a<c.

[6] These criteria are stated formally on P500 of the paper by Sen (1993). The expansion consistency property (property ϒ) requires that an element x that is chosen from every set in a particular class must be chosen also from the union. The basic contraction consistency property (property α) demands that an alternative which is chosen from a set S and belongs to subset T of S must be chosen from T as well. The citation for the paper by Sen (1993) is:

Sen A. Internal consistency of choice. Econometrica. 1993. 61: 495-521.

[7] In compensatory decisions, when the final values for attributes are computed, negative attributes can be compensated for by equal or higher value positive attributes.

Kjaer et al (2012)	-	✓	-	-	-	-	-	-	✓
Mohamed et al (2011)	-	✓	-	-	-	✓	✓	✓	✓
Morton et al (2012a)	-	✓	-	-	-	-	✓	✓	✓
Morton et al (2012b)	-	✓	-	-	-	-	✓	✓	✓
Park et al (2012)	-	✓	✓	-	-	-	-	-	-
Reese et al (2010)	-	✓	-	-	-	-	✓	✓	✓
Whitman et al (2013)	-	✓	-	-	-	-	-	-	-
Total	**0**	**14**	**1**	**0**	**0**	**1**	**9**	**9**	**11**

Supplementary Table 12. Validity tests (further details).

Authors	Validity tests – Use of qualitative methods to enhance DCE process and results – Strengthening understanding through de-briefing choices.	Validity tests – Other	Details of other validity tests	Validity tests – none apparent
Clark et al (2009)	-	-	-	-
Clark et al (2012)	-	-	-	-
Davison et al (2010)	-	-	-	-
Foote et al (2014)	-	-	-	-
Halpern et al (2004)	-	✓	They claim "we assessed patients' adherence to monotonicity – the principle that patients should never be more willing to switch when a lower level of one attribute is offered while levels of other attributes are held constant."	-
Howard et al (2015a)	-	-	-	-
Howard et al (2015b)	-	-	-	-
Kjaer et al (2012)	-	✓	Collected information about respondents self-perceived difficulty in completing DCE questionnaires (whether easy, difficult, or very difficult).	-
Mohamed et al (2011)	✓	✓	Pilot 'think aloud' exercise with attention paid to whether simplifying heuristics might be deployed.	-
Morton et al (2012a)	✓	✓	A practice question was included before the 12 DCE questions.	-
Morton et al (2012b)	✓	✓	A practice question was included before the 12 DCE questions, and a secondary analysis of 75 patients who answered the practice question correctly showed no significant differences to the main analysis.	-
Park et al (2012)	-	✓	DCE results were considered alongside a ranking (P936) of adverse events (in order of severity) undertaken by doctors and nurses.	-

Reese et al (2010)	-	-	-	-
Whitman et al (2013)	-	-	-	-
Total	**3**	**6**	**-**	**0**

Supplementary Table 13. Main objectives and output of DCEs.

Authors.	A. Patient consumer experience.	B. Valuing Health Outcomes.	C. Investigate trade-offs between health outcomes and patient or consumer experience factors	D. Estimating utility weights within the QALY framework	E. Job choices for preferences relating to medical posts or healthcare human resource policy.	F. Developing priority setting frameworks	G. Health professionals preferences for treatment or screening options for patients	H. Other	Total number of objectives per analysis.
Clark et al (2009)	-	-	-	-	-	✓	-	-	1
Clark et al (2012)	-	-	-	-	-	✓	-	-	1
Davison et al (2010)	-	-	-	-	-	✓	-	-	1
Foote et al (2014)	-	-	-	-	-	-	✓	-	1
Halpern et al (2004)	-	-	✓	-	-	-	-	-	1
Howard et al (2015a)	-	-	-	-	-	✓	-	-	1
Howard et al (2015b)	-	-	-	-	-	-	-	✓	1
Kjaer et al (2012)	-	-	-	-	-	✓	-	-	1
Mohamed et al (2011)	-	-	✓	-	-	-	-	-	1
Morton et al (2012a)	-	-	✓	-	-	-	-	-	1
Morton et al (2012b)	-	-	✓	-	-	-	-	-	1
Park et al (2012)	-	-	✓	-	-	-	✓	-	2
Reese et al (2010)	-	-	-	-	-	✓	-	-	1
Whitman et al (2013)	-	-	-	-	-	-	✓	-	1
Total	**0**	**0**	**5**	**0**	**0**	**6**	**3**	**1**	**-**

Supplementary Table 14. Presentation of key findings for applied use.

Authors.	Per Willingness to Pay Unit.	Per time period.	Per risk unit.	Monetary welfare measure.	Utility score.	Odds ratio.	Probability score.	Other (described)
Clark et al (2009)	--	✓	-	-	-	-	-	-
Clark et al (2012)	-	✓	-	-	-	-	-	-
Davison et al (2010)	-	-	-	-	-	-	-	✓ Rank order importance of attributes.
Foote et al (2014)	-	-	-	-	-	✓	-	-
Halpern et al (2004)	-	-	-	-	-	-	-	✓ Willingness to switch dialysis.
Howard et al (2015a)	-	-	-	-	-	✓	-	✓ Odds ratio of receiving an organ.
Howard et al (2015b)	-	-	-	-	-	✓	-	✓ Odds ratio of preferring new to current policy
Kjaer et al (2012)	✓	-	-	-	-	-	-	-
Mohamed et al (2011)	-	-	-	-	-	-	-	✓ Marginal rate of substitution with respect to progression-free survival [PFS].
Morton et al (2012a)	-	-	-	-	-	✓	-	✓ Willingness to trade life expectancy to improve another attribute.
Morton et al (2012b)	-	-	-	-	-	✓	-	✓ Prefer conservative care or dialysis (odds ratios).

Park et al (2012)	-	-	-	-	-	✓	-	✓ Relative importance of attributes and Marginal rates of substitution between attributes.
Reese et al (2010)	-	-	-	-	-	✓	-	✓ Willingness to accept a kidney from a donor at Increased Risk of blood borne Viral Infection (DIRVI)
Whitman et al (2013)	-	-	-	-	-	✓	-	-
Total	**1**	**2**	**0**	**0**	**0**	**8**	**0**	**9**

Supplementary Table 15: Was information collated relating to the ethnicity or language group of respondents, and was data analysis relating to ethnicity and language group conducted?

Authors	Was information collated about ethnicity and language groups	Are findings presented in terms or ethnicity / language group?
Clark et al (2009)	Yes: Information collated about the ethnic group of patients.	Yes: Amongst non-white ethnic minorities having a close match between donor and recipient was not significantly valued. However, amongst patients who were not in this ethnic group having a close match between donor and recipient was positively valued
Clark et al (2012)	Yes: Information collated about the ethnic group of patients.	Yes: Amongst South Asian ethnic minorities, and for a more general ethnic minority group having a close match between donor and recipient was not significantly valued. However, amongst patients who were not in these ethnic groups having a close match between donor and recipient was positively valued
Davison et al (2010)	Yes: Compiled information about the racial profile of the sample (e.g. percentage white, percentage other, and percentage missing responses).	No: Sub-group analysis according to the race of respondents was not reported.
Foote et al (2014)	Yes: Compiled information about the racial profile of the sample (e.g, number and percentage by ethnicity [Caucasian, Asian, Arab, and Other]).	Yes: The ethnicity of Nephrologist respondents was found to have no significant effect upon preferences for recommendation of dialysis to elderly patients.
Halpern et al (2004)	Yes: Information upon the racial profile of the sample was compiled (e.g. non-hispanic black, non-hispanic white, and other).	Yes: The findings of the data analysis suggested that race was not independently a significant determinant of willingness to switch renal dialysis regimen.
Howard et al (2015a)	Yes: The study reported information about whether respondents English at home.	No: This language group information did not appear to be used to underpin sub-group data analysis.
Howard et al (2015b)	Yes: Information about whether respondents spoke English at home, and also whether respondents spoke a second language at home (e.g. Mandarin, Cantonese, Italian, Vietnamese, Greek, and Arabic.	Yes: Results of the latent class analysis did not suggest that language group was a significant determinant of latent class membership (and hence of preferences).
Kjaer et al (2012)	No: No information about ethnic group or language group was collated.	No: It did not conduct ethnicity or language group analysis. However the questionnaire was professionally translated from Danish to Greenlandic.
Mohamed et al (2011)	Yes: Information was collated about the number of respondents who were African American, Caucasian, or of other ethnicity.	No: The impact of race upon DCE findings was not considered.

Morton et al (2012a)	No: No information about ethnic group or language group was collated.	No: No analysis relating to ethnic group or language group was conducted.
Morton et al (2012b)	No: No information about ethnic group or language group was collated.	No: No analysis relating to ethnic group or language group was conducted.
Park et al (2012)	No: No information about ethnic group or language group was collated.	No: No analysis relating to ethnic group or language group was conducted.
Reese et al (2012)	Yes: Information about the racial profile of people (e.g. White, African American, Hispanic, and Other).	Yes: Unadjusted data analyses suggested that being of black race, was associated with greater likelihood of accepting a kidney from a donor at increased risk of blood-borne viral infection.
Whitman et al (2013)	No: No information about ethnic group or language group was collated.	No: No analysis relating to ethnic group or language group was conducted.